

PERMIAN AND TRIASSIC INSECTS FROM NEW
SOUTH WALES, IN THE COLLECTION OF MR.
JOHN MITCHELL.

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(With seventeen Text-figures).

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INTRODUCTION.

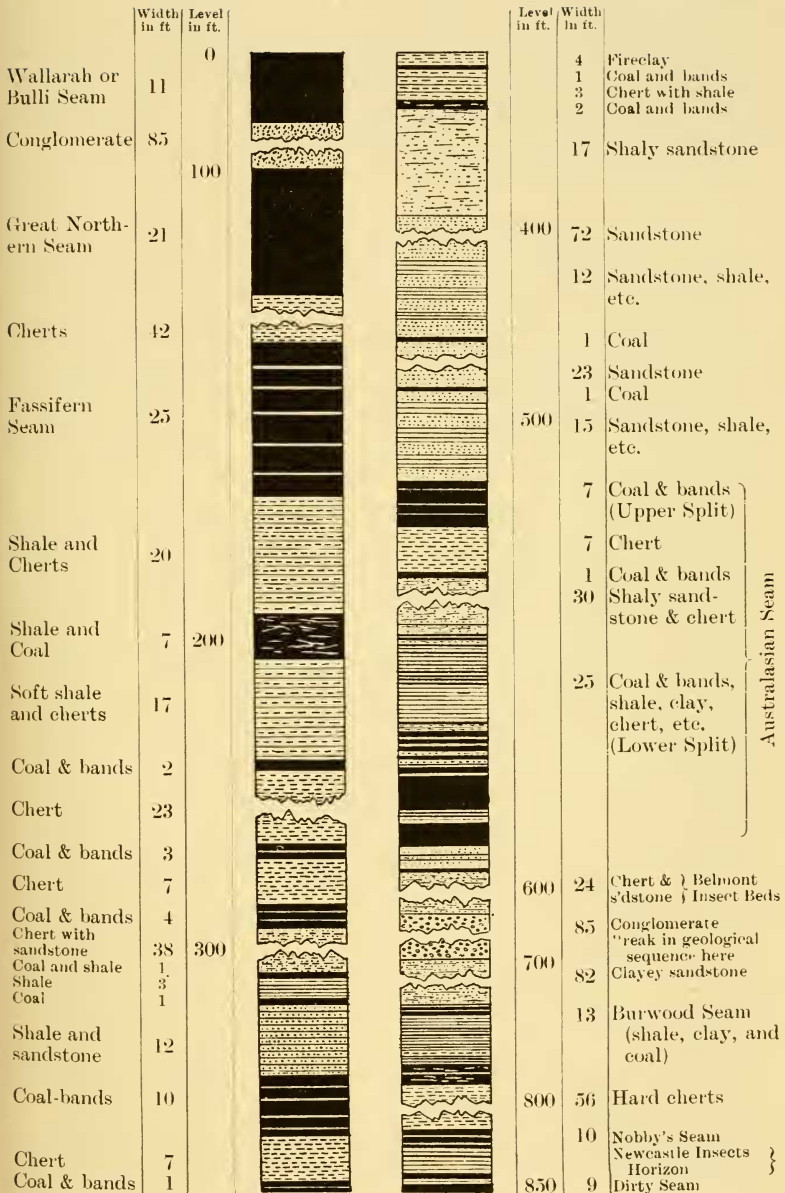
In 1916, Mr. John Mitchell, late Principal of the Newcastle Technical College, very kindly sent me the fossil insects in his collection, for study. The collection consisted of thirty-six specimens, of which twenty-five were from the Wianamatta Shale deposits of Narellan and Glenlee, ten from the Upper Coal-Measures of the Newcastle District, and a single specimen from Silurian strata. This last, as might be expected, proved, on examination, not to belong to the Insecta. In forwarding these specimens, Mr. Mitchell also told me that the most perfect specimen of all, from the Coal-Measures, was not included in the collection, as it had been stolen during an exhibition of the specimens at Newcastle.

Several of the specimens forwarded do not belong to the Insecta, while there are a number that are too fragmentary to enable me to place them at all definitely. When all these have been eliminated, there remain twelve specimens which I considered it worth while to name, figure, and study in detail. Of these, eight are from the Wianamatta Shale, and four from the Coal-Measures. The other specimens are dealt with more briefly, under the headings of Insects Incertæ Sedis, for their respective geological horizons. The numbers, by which the specimens are alluded to, are those affixed to the actual specimens by Mr. Mitchell. The specimens carry no other labels, unless such are specially mentioned. To each specimen which I have made the type of a new species, I have affixed a label in my own handwriting, indicating that fact.

I should like here to express my grateful thanks to Mr. Mitchell for his kindness in allowing me to study these valuable fossils. As I hope to show in this paper, the conclusions to be drawn from even this small collection, particularly with regard to the Permian fossils, are far-reaching, and of great importance in the study of the Phylogeny of the Insecta. I desire also to thank him for supplying me with interesting data as to the age and position of the fossils. The details given in this paper, as to the exact horizons of the various Insect-bearing Beds, are compiled from very complete and detailed information contained in a series of letters sent to me by Mr. Mitchell on this subject. As regards the age of the Upper Coal-Measures and of the Wianamatta Shale beds, I have to thank both Mr. Mitchell and Mr. A. B. Walkom, B.Sc., Assistant Lecturer in Geology in the University of Queensland, for their valuable help in deciding these questions for the purposes of this paper.

The geological evidence has been given at some length, because the character of the Permian fossils here described is such that the age assigned to them might well be questioned by geologists in the Northern Hemisphere, if the evidence admitted of any doubt on the matter. I believe I am right in stating that *no remains of undoubted Holometabolous Insects are, so far, known from any Palaeozoic strata*. As the Mecoptera appear to have been well represented in the Newcastle Coal-Measures, by forms differing little from those still living in Australia, the importance of this discovery will be at once recognised. Further, as the subdivision of the extensive Order Hemiptera into its two Suborders, Heteroptera and Homoptera, is generally supposed not to have taken place before Triassic times, the occurrence of an almost perfect tegmen of a definite Cercopid type in these Coal-Measures is of very great interest.

The fossils from the Wianamatta Shale are mostly similar to forms already described from the St Peter's beds, near Sydney. The single specimen from the later horizon at Narellan belonged to a genus so far confined to Ipswich, where it is abundant. Thus there is a basis for the suggestion that further work at this particular horizon of the Wianamatta Shale beds might result



Text-fig. 1.—Section through the Upper Coal-Measures, Lake Macquarie Basin to Newcastle, N.S.W., from the top (Wallarrah Seam) to the Dirty Seam. Reduced and simplified from original section by Prof. T. W. E. David, F.R.S.

in the establishment of a correlation between it and the Insect-Bed at Ipswich. It is, in any case, important to have both the Wianamatta and Ipswich Beds definitely fixed as Upper Triassic, a conclusion which Mr. Walkom's recent researches seem to make fully justified.

SECTION A. THE PERMIAN INSECTS.

The ten specimens from the Newcastle Coal-Measures are numbered 23 to 32 inclusive. Of these, Nos. 23 and 32 were taken from just above the Dirty Seam at Newcastle, at a place near the Soldiers' Baths, about two feet above high water-mark. Nos. 24 to 31 inclusive come from the Belmont Fossil Beds, about two miles on the Newcastle side of Belmont, a village on the northern shore of Lake Macquarie, some three miles from the Pacific Ocean.

Both the Newcastle and the Belmont specimens come from well within the Upper Coal-Measures. In Text-fig. 1, I offer a section taken through the upper two thirds of these measures, from the shores of Lake Macquarie up to Newcastle. This section is simplified and abbreviated from Section No. 12, published by Professor David in his well-known work on the Geology of the Newcastle and Greta Coal-Measures (Mem. Geol. Survey, New South Wales, Geol. No. 4). It gives the succession of strata from the top of the Coal-Measures (Wallarah Coal-Seam) to a vertical depth of about 850 feet (top of the Dirty Seam). Below this, there lies a thickness of another 400 feet, not shown in the figure, including the Borehole and Waratah Coal-Seams.

Mr. Mitchell has kindly marked for me the exact positions of the strata from which the insects were taken. The Belmont Insect-Beds consist chiefly of hard cherts and shaly sandstones, lying at a vertical level of about 600 feet below the top of the Upper Coal-Measures, and succeeded by a very thick stratum of conglomerate, containing waterworn pebbles of coal. Below this, in the actual section shown by Professor David, there is a definite break in the geological sequence; but Mr. Mitchell informs me that this break is only a local one, and not of much consequence. Its only effect would be to increase somewhat the

actual difference in geological time between the Belmont fossils and those from the top of the Dirty Seam at Newcastle. These latter, even if nothing is allowed for the break, lie some 250 feet below the horizon of the Belmont Beds. They are, therefore, by far the oldest, fossil insect-wings so far discovered in Australia.

The Upper Coal-Measures, in which the insects are found, are generally classed in text-books as Permo-Carboniferous. This name, first suggested by Mr. R. Etheridge, Junr., is applied to the immense series of marine and freshwater beds, totalling a maximum thickness of about 17,000 feet, which overlie the true Carboniferous Beds in New South Wales, and are, in turn, followed by the freshwater Triassic strata. The marine beds contain a fauna which shows affinities with both Carboniferous and Permian marine faunas of the Northern Hemisphere. The name Permo-Carboniferous is an attempt to emphasise this fact. When, however, we come to apply the term to the freshwater beds of the Upper Coal-Measures, we are met with the difficulty that this Permo-Carboniferous affinity with the Northern Hemisphere faunas does not exist in this case, since the flora displays a more decidedly Mesozoic aspect, and does not possess a single one of the Carboniferous genera. The *Calamites*, *Lepidodendron*, and *Rhucopteris* of the Carboniferous have disappeared; and, in their places, we find *Phyllothea*, *Schizoneura*, *Alethopteris*, *Sphenopteris*, and *Baiera*, all represented also in the Triassic, together with an abundant *Glossopteris*-flora (which is typical of the Permo-Carboniferous only), *Annularia*, *Gangamopteris*, *Vertebraria*, *Dadoxylon*, and other genera not found in the Trias. Thus, as far as the flora is concerned, it would be more logical to coin the term Triasso-Permian for it, than to retain the term Permo-Carboniferous. As the Insects studied in this paper have nothing in common with any known Carboniferous fauna, but show distinct affinity with the Triassic forms already brought to light, I think that I should be open to the charge of misleading students of Palæo-entomology in other parts of the world if I classed them as Permo-Carboniferous. The term Permian is less open to objection, and I have adopted it in this paper. As all the

insects occur within the first 1,000 feet in vertical depth below the bottom of the Triassic, out of a total of 17,000 feet for the whole of the Permo-Carboniferous strata, it will be seen that one might even be justified in describing them as Upper Permian.

Geologists recognise the dividing line between the Permian and Lower Triassic strata to be the disappearance of *Glossopteris*, and the advent of the various species of *Thinnfeldia* and *Tanipteris*. The Belmont insects are found associated with various species of *Glossopteris*, and with the interesting bivalved Crustacean, *Levia mitchelli* Eth., belonging to a genus of which the type-species is found in the Permo-Carboniferous of the United States. The Newcastle Insects, Nos. 23 and 32, were found associated with *Glossopteris linearis* McCoy, *G. browniana* Brongn., and many other species of this genus, together with *Sphenopteris germanus* McCoy, and with *Phyllotheca*.

The important point to bear in mind, for students of Palæoentomology, is that these insects are undoubtedly Palæozoic; and, as such, they exhibit a fauna which promises to be, when more fully explored, quite unlike anything at present known from Palæozoic strata.

DESCRIPTIONS OF THE SPECIMENS.

i. *Insect from the top of the Dirty Seam, Newcastle.*

Order **HEMIPTERA.**

Suborder **Homoptera.**

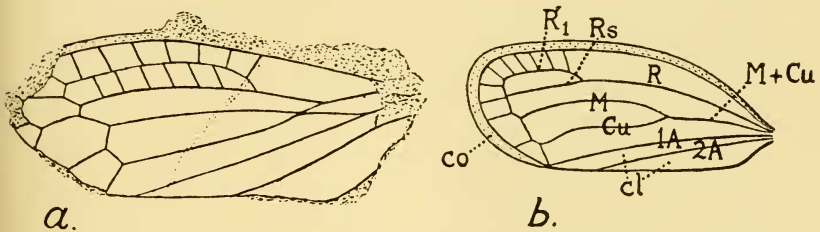
Family **CERCOPIDÆ.**

Subfamily **CERCOPINÆ.**

Genus **PERMOSCARTA**, n.g. (Text-fig.2).

Fairly small insects (tegmen about 6 mm.), with strongly built tegmina, finely tuberculate all over; the claval area of the usual Cercopid form, bounded anteriorly by the straight and strongly-formed vein 1A, and traversed near the middle by the subparallel and slightly wavy 2A; anal angle of the clavus not very sharply formed; the tuberculation extends all over the claval area. The tuberculation of the rest of the wing (corium) is slightly more definite in the basal than in the distal half, the

division between the two portions being faintly visible as an oblique line running from the costa, just above the origin of R_s , obliquely outwards and downwards to join the clavus close up to its distal angle. Costa edged by a distinct coriaceous border, which probably extended right round to 1A, as in most recent forms. R_s arising from R at about two-fifths of the wing-length, and continuing the line of R directly distad; R_1 arching strongly up anteriorly, and then turning so as to run halfway between C and R_s , parallel to both, and connected with both by a number of faintly indicated, slightly oblique cross-veins. M leaving R a little before one-fourth of the wing-length, and, very soon after, meeting Cu near its base, fusing with it for a very short distance,



Text-fig. 2.

a., *Permoscarta mitchelli*, n.g. et sp., tegmen (length 6.4 mm.). Newcastle, Permian. The division between the stronger basal and weaker distal tuberculation of the wing-membrane is marked by the double dotted line, but the tuberculation itself is omitted. *b.*, Tegmen of *Eoscarta semirosea* (Walk.). Recent; Oriental Region. Tuberculation omitted; *cl*, claval area; *co*, coriaceous border.

and then diverging from it in the usual manner, so as to run longitudinally through the middle of the corium. Cu runs nearly parallel with 1A. R_1 , R_s , M, and Cu all fork widely in the last quarter of the wing-length, the branches of the forks uniting in the usual manner to form a series of four *apical cells*; but the stem formed by the union of the lower branch from R_s and the upper branch from M again forks widely as it approaches the wing-border. The lower branch from Cu reaches the border just beyond 1A.

Genotype: *Permoscarta mitchelli*, n.sp.

Horizon: Upper Coal-Measures of Newcastle, N.S.W.

So little appears to be known about the *Cercopinae* of Australia, that I am not able to indicate any named Australian species as showing affinity with this form. But there are a number of genera figured in Distant's excellent work on the Rhynchota of British India, Vol. iv., (in the "Fauna of British India") which appear to be closely related to this Permian fossil. For example, the genus *Eoscarta* Bredd., widely distributed in the Oriental Region, might well be the direct descendant of a form such as *Permoscarta*, as may be seen by referring to Text-fig. 2. A shifting of the origin of R_s distad along R to beyond halfway, a consequent reduction in the number of cross-veins connecting R with C and R_s , a simplification of the basal union of M and Cu , and finally a shortening of the apical cells, with elimination of the anomalous extra fork already noted at the tip of the wing, would convert *Permoscarta* by reduction into *Eoscarta*. Very possibly there still exist in Australia to-day forms more closely allied to *Permoscarta* than this Oriental genus is. It is to be hoped that the discovery of this fine fossil will stir up interest in our beautiful *Cercopidae*, amongst the smaller forms of which much work still remains to be done.

PERMOSCARTA MITCHELLI, n sp. (Text-fig. 2a).

Characters as given for the genus, with the following additions: *Total length of tegmen*, 6.4 mm; *greatest breadth*, 2.7 mm., at level of distal end of 1A.

All the veins very distinctly marked, except the small basal portion of Cu and the whole of R_1 , with its upper and lower series of cross-veins. In the first two drawings that I made of this insect, I completely failed to detect R_1 ; the third drawing was made under the camera-lucida in very strong, oblique, evening sunlight, in which, to my surprise, the whole of R_1 and its cross-veins showed up very clearly, when the wing was placed in a certain position only.

The specimen, which is beautifully preserved, is complete except for the absence of the greater part of the coriaceous border (which is, however, very distinctly marked distally above R_1), a

small piece cut out from the apex of the wing above the upper branch of Rs, and slight breaking away of the border distally beyond the end of 1A, and also basally on the clavus.

The specimen lies on the smooth, ochreous-grey surface of a very hard rock, and is of a somewhat darker colour (ochreous-brown) than the rock-surface. It also carries black, carbonised patches, which are quite absent from the rock itself, and may possibly be due to the carbonisation of an original wing-pigment. These markings take the form of a black band along the coriaceous border, with irregular patches extending in as far as R₁, a very definite mottling of black specks, inclined to run together, on the distal half of the corium, and a similar but less distinct mottling on the broad basal half of the clavus.

Type, Specimen No.23 in Coll. Mitchell.

Locality:—Taken from the top of the Dirty Seam, Newcastle, N.S.W., near the Soldiers' Baths, at a level about two feet above present highwater-mark. The depth of this horizon below the top of the Permian Coal-Measures is, as has been already indicated, at least 850 feet.

ii. *Insects from the Belmont Beds.*

Order **HEMIPTERA.**

Suborder **Homoptera.**

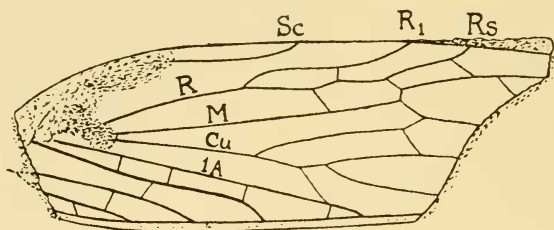
Family **PERMOFULGORIDÆ**, fam.nov.

Medium-sized insects, with rather narrow, elongated tegmen, in which certain cross-veins join obliquely with the main veins, so as to simulate dichotomous branchings of the latter, and thus form a series of apical cells, after the manner of recent *Cicadidae*. Claval area with unspecialised, anal veins; the typical Y-vein of recent *Fulgoridae* not formed. Coriaceous border of posterior margin of wing runs on distally beyond the end of the claval area.*

* This extraordinary character at once suggests the *suture* of the Coleopterous elytron. It is possible that we have here the first formation of that structure; but the Homopterous nature of this fossil seems fairly clear.

Genus *PERMOFULGOR*, n.g. (Text-fig.3).

Characters as for the family, with the following additions. Tegmen of delicate structure, not tuberculate, broadest not far from the base; costal border slightly convex. Veins of the clavus very strongly developed; those of the corium much weaker, and not easy to make out. Veins 1A and 2A apparently both two-branched from near their bases. Sc present, but ending up on the costal border well before halfway along the wing. R, M, and Cu apparently all closely united near their bases. R leaves M to run obliquely towards the costal border, and, at a level a little before the end of Sc, divides into R_1 and R_s , the latter continuing the line of the main stem, while R_1 arches upwards



Text-fig.3.

Permofulgor belmontensis, n.g. et sp.; tegmen (length of fragment 9.5mm.).
Belmont; Permian.

towards Sc, then runs parallel to the wing-border for some distance, and finally meets it in an upward curve; about halfway along R_1 , a cross-vein connects it with R_s . M runs straight below R, gradually approaching the costal border, but not reaching it. Cu diverges from M, becoming subparallel to 1A; Cu gives off an anterior branch Cu_1 a little beyond the level of the origin of R_s ; the main stem (Cu_2) is broken a little further on, at a point where a long, oblique cross-vein connects it with 1A, and shortly afterwards divides into Cu_{2a} and Cu_{2b} . At about two-thirds of the wing-length, R_s , M, Cu_1 , and Cu_{2a} are connected by a set of three oblique cross veins, forming the bases of three *apical cells*, of which the two uppermost, at least, are again divided by oblique cross-veins nearer to the apical border. [Rest of tegmen missing].

Genotype, *Permofulgor belmontensis*, n.sp.

Horizon: Upper Coal-Measures of Newcastle, N.S.W.

Although this fossil appears, at first sight, to belong to the *Fulgoridae*, yet it differs from that family, as known to us at the present day, in a number of characters, chiefly amongst which must be reckoned the absence of the typical Y-vein of the claval area, which is peculiar to the *Fulgoridae* alone amongst the Homoptera. Hence it is necessary to place it in a new family, which probably had close affinity with the ancestors of our recent *Fulgoridae*, but clearly also does not lie in their direct ancestral line. This family also foreshadowed, in the arrangement of the oblique cross-veins in sets, the later development of the *Cicadidae*, which appear to have arisen in Cretaceous times.

In spite of its occurrence at a higher level in the Permian than the Newcastle fossil *Permoscarta* described above, this insect is clearly of a far more archaic type than the latter. But this need not surprise us, when we consider that the *Fulgoridae* of to-day still contain numerous forms with a dense, archaic, almost Neuropteroid venation, which must have been handed down with little change from very early ancestors.

PERMOFULGOR BELMONTENSIS, n.sp. (Text-fig.3).

Characters as given for the genus, with the following additions. *Total length of the wing-fragment*, 9.5 mm; *greatest breadth*, 3 mm.; *probable total length of tegmen*, 11 mm. The extreme base, as well as a considerable part of the apical area of the wing, is missing. There appear to be at least five weak cross-veins connecting the main veins of the claval area, as shown in Text-fig.3; but there may be more. Very careful manipulation of strong oblique light is necessary to follow the venation of the corium, and it is possible that I have omitted some cross-veins in this part of the wing also.

The specimen lies on the smooth, pale grey surface of a cherty rock, and would certainly have shown more detail if its actual venation had been strongly formed. This is proved by the fact, that the veins of the clavus stand up clearly and sharply from the smooth surface of the impression, whereas the veins of the corium are scarcely to be detected in a cursory glance.

Type, Specimen No.31 in Coll. Mitchell.

Locality: Belmont Beds at a depth of about 600 feet below the top of the Permian Coal-Measures.

Specimen No.25 appears to belong to this genus also; but, as it shows clearly only the strong veins of the clavus, I have not considered it worth naming.

Order **Mecoptera**.

Family PERMOCHORISTIDÆ, fam.nov.

Scorpion-flies closely resembling the recent Australian *Choristidæ*, especially the genus *Teniochorista*, with which they agree in having many of the cross-veins very weakly formed and almost obsolete. Rs four-branched, the bifurcation of R_{2+3} taking place much further distad than that of R_{4+5} . M sends six branches to the apical margin of the wing. Cu_1 a straight vein without any branches. The main stem of M is fused basally with Cu_1 , and arises from it at a level far basad from that of the origin of Rs.

Genus PERMOCHORISTA, n.g. (Text-figs.4-6).

Medium sized insects (forewing about 10 mm. long) with moderately broad, well-rounded wings. Sc well-developed, reaching beyond half-way along the costal margin. Pterostigma well-developed, elongated, crossed by some weak cross-veins. Cross-veins moderately numerous, very weakly formed, and not specially arranged in such a way as to cause any bendings of the main veins, or the formation of the typical elongated hexagonal cells of more recent Mecoptera. Towards the apex, the cross-veins are either completely absent, or so weakly formed that they cannot be identified in the fossils.

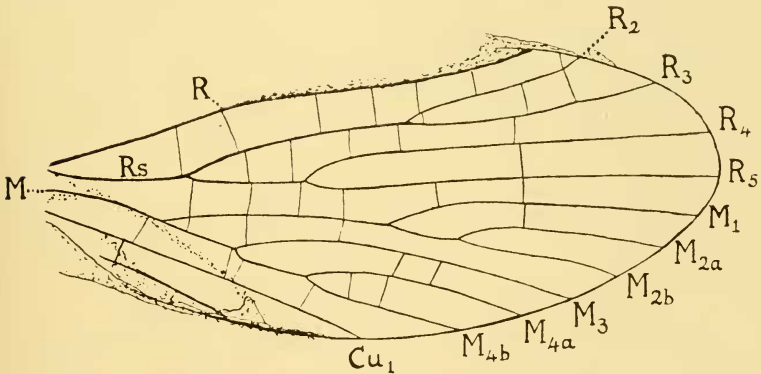
Genotype, *Permochorista australica*, n.sp.

Horizon: Upper Coal-Measures of Newcastle, N.S.W.

The fossil wings of this genus already known are certainly three, and probably four, in number. Two are in Mr. Mitchell's Collection, and are here described. A third is at present on loan to the Natural History Museum in Paris, and would by now have been returned to me for study, had it not been for the risk

of sending so valuable a specimen by sea. This specimen is absolutely perfect, as far as my memory of it goes, and is the property of one of Mr. Süssmilch's students at Newcastle. The specimen stolen from Mr. Mitchell was also, I gather, a perfect specimen of this or a closely allied genus. It would appear, therefore, that the Mecoptera were quite abundantly represented in the fauna of the Permian Coal-Measures at Newcastle. As there has not been, up to the present, a single fossil Holometabolous Insect described from any Palæozoic strata, the discovery of these insects is of outstanding importance, suggesting, as it does, that the Mecoptera may prove to be the most ancient of all Holometabolous Insects. In this connection, it will be necessary for special search to be made for the elytra of Coleoptera in the Belmont and Newcastle beds; since, if such existed at that period, they will almost certainly soon be brought to light.

The two species described here under this genus are clearly closely allied, and it is even possible that they may really be the fore- and hindwing respectively of a single species.



Text-fig.4.

Permochorista australica, n.g. et sp., wing (length 8·5 mm.). Belmont;
Permian.

PERMOCHORISTA AUSTRALICA, n.sp. (Text-fig.4).

An almost complete wing, 8·5 mm. long, with only the costa, subcosta, and the portion of the base of the wing missing. The impression is a good one, upon the smooth surface of a dark grey

cherty rock. All the main veins are outlined to perfection, but the cross-veins are mostly only to be made out very indistinctly, in strong oblique light. A few cross-veins are somewhat more distinct; such as, for instance, the strong cross-vein passing from M_4 , just distally from its origin, to Cu_1 , and causing a distinct bend in the former vein, and also the cross-vein descending from close up to the bifurcation of R_{2+3} upon R_4 . The feeble development of the cross-veins in such an excellently preserved wing proves them to have been at the stage seen in the recent genus *Teniochorista*—a stage preliminary to the complete elimination of all except a very few advantageously placed cross-veins, such as we find in the derived Orders Trichoptera, Lepidoptera, and Diptera.

As far as can be gathered from this impression, the wing was quite smooth except in the pterostigmatic region, which appears to have been either granulate, or beset with rather crowded macrotrichia. The main veins probably carried macrotrichia of rather small size, and closely set together; in some places, as, for instance, on the stem of R_s , there are indications that the macrotrichia were arranged in two rows close together. But the grain of the rock prevents us from determining this point with certainty. Microtrichia may, or may not, have been present, as the grain of the rock is not fine enough to show them in any case.

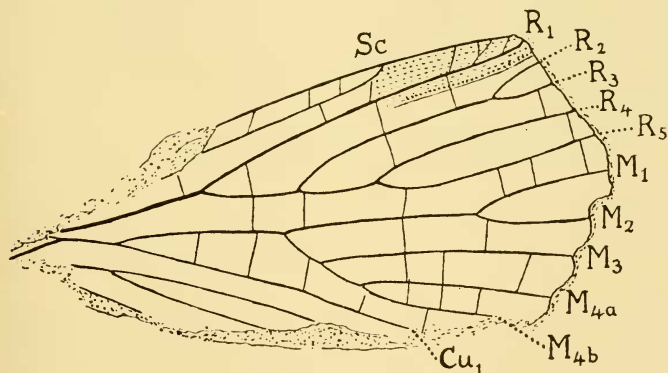
Type, Specimen No.24 in Coll. Mitchell.

Locality: Belmont Beds, at a depth of about 600 feet below the top of the Permian Coal-Measures.

PERMOCHORISTA MITCHELLI, n.sp. (Text-fig.5).

A fragment comprising about two-thirds of a complete wing, with a considerable part of the apical area missing, but the base and costa more complete than in the previous specimen. Total length of the fragment 7.5 mm.; this indicates a somewhat larger, and certainly a distinctly broader wing than that of *P. australica*. The end of Sc , with three cross-veins running to the costa above it, is very clearly marked: likewise the pterostigma, with signs of three cross-veins within its distal half, and

distinct indications of the pterostigmatic furrow below R_1 . The origin of R_s , which is just missing in *P. australica*, is beautifully shown in this specimen, as is also the origin of M from Cu_1 at a level considerably basad from that of the origin of R_s , and the approach of R to the combined stalk $M + Cu_1$ close to the base. There are also signs that this fusion of M with Cu_1 is not complete basally, Cu_1 appearing distinctly bent basad from the combined stem, while a tiny portion of M is preserved running basad towards R . All four branches of R_s are shown, the bifurcations of R_{2+3} being placed at a level far distad from that of R_{4+5} . Correlated with the evident greater breadth of the wing, in comparison with that of *P. australica*, is the wider form of the bifurcations of M , of which there are five distinct branches shown, as far as the wing is preserved distally. A greater length of M_2 is preserved unbranched, than that of the basal stalk of this vein before it branches in *P. australica*; yet it would be unwise to assert that this vein remains unbranched, since the wing is evidently somewhat larger.



Text-fig.5.

Permochorista mitchelli, n.g. et sp., wing (length 7.5 mm.). Belmont; Permian.

Of the cross-veins shown in the figure, some are approximately in the same positions as those of *P. australica*, others not. Probably the position of the cross-veins was as variable as it is

in the recent genera *Chorista* and *Teniochoista*; in any case, it is not at all likely that I have been able to discover by any means all of the cross-veins actually existing in either specimen.

Below Cu_1 there is a nearly parallel vein, giving off a posterior branch which runs nearly parallel with it. As this appears to be a somewhat weak vein, and there is a portion of a much stronger vein running below it, I think that its upper branch may prove to be Cu_2 , the stronger vein being 1A, which unites with Cu_2 near the base by a weaker branch. If the basal stem of this weak vein be continued proximad, it will run into the bent basal end of Cu_1 above it. This would agree very well with the peculiar formation of Cu and 1A basally in recent Mecoptera, allowing for greater specialisation in this respect in the recent forms. I have, therefore, marked the straight, strong vein, which fuses with M for a short distance near the base, Cu_1 , and the upper branch of the weak, branched vein Cu_2 ; but I do not consider that the naming of these veins is placed beyond doubt.

The impression is a fairly good one, upon the smooth surface of a cherty rock of a somewhat lighter colour than that on which the former specimen is impressed; the main veins are also somewhat fainter.

Type, Specimen No.26 in Coll. Mitchell.

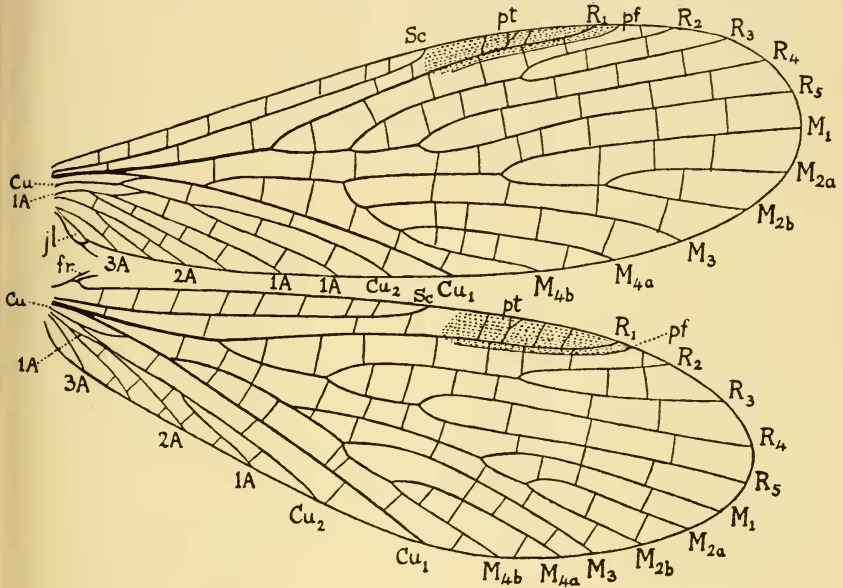
Locality: Belmont Beds, at about the same level as the previous specimen.

RESTORATION OF THE WING-VENATION IN THE GENUS PERMOCHORISTA. (Text-figs.6-7).

The preservation of the two wings, *Permochorista australica* and *P. mitchelli*, is sufficiently complete to enable us to restore the venational type of the genus with very fair accuracy. To do this, we must call to our aid the recent genus *Teniochorista*, which, as I have already indicated, is clearly a close ally, and possibly even a direct descendant, of *Permochorista*.

The venation of *T. pallida* Esb.-Pet., from Brisbane, is shown in Text-fig.7. It will be noticed at once that the forewing is distinctly broader in the basal half than is the hindwing; also

that, in the forewing, the branchings of M spread out more widely from their common stalk than they do in the hindwing. Now, if we compare these conditions with the two fossil wings of *Permochorista*, we shall see at once that *P. australica* resembles the hindwing of *T. pallida*, both in its narrowing towards the



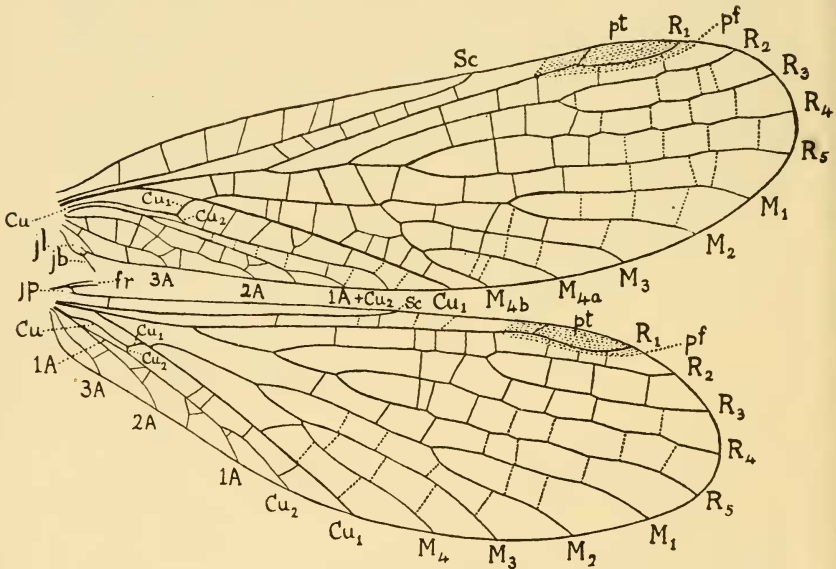
Text-fig.6.

Restoration of the typical venation for the genus *Permochorista*, n.g.

Forewing restored from *P. mitchelli*, hindwing from *P. australica*; fr., frenulum; jl., jugal lobe; pf, pterostigmatic furrow; pt, pterostigma.

base, and in the direction taken by the branches of M from their common stalk; the principal difference being that, in *T. pallida*, M sends only *four* branches to the wing-border (as in all recent Mecoptera, except *Merope*, which has five), whereas in *P. australica* there are no less than *six*. The position and number of the branches of Rs is the same in both *P. australica* and *T. pallida*. The only other important difference is to be found in the slight irregularity of the courses of the main veins in *T. pallida*, as contrasted with the absolutely regular main veins of

P. australica. This irregularity takes the form of a very weak zigzagging of the main veins as they pass from one cross-vein below to another above, alternately. It is a specialisation from an originally regular condition, and is the direct result of the cross-veins becoming arranged in the most advantageous position as supports, *i.e.*, alternately above and below each main vein. The same line of evolution can be seen in the Odonata, where it affects alternate main veins only (*e.g.*, M_4 and Cu_2 in many *Agrionidae*), and in the radial sector of *Planipennia*. On these grounds, therefore, we are justified in considering *P. australica* to be represented by a *hindwing*.



Text-fig. 7.

Teniochorista pallida Esb.-Pet.; wings. Recent; Brisbane. For comparison with *Permochorista*. The dotted cross-veins are obsolescent; *fr*, frenalium; *jb*, jugal bristle; *jl*, jugal lobe; *jp*, jugal process; *pf*, pterostigmatic furrow; *pt*, pterostigma.

Turning now to the less complete *P. mitchelli*, we see at once that it more closely resembles the *forewing* of *T. pallida*, not only because of its greater breadth towards the base, but also

because of the very typical formation of the branches of M, which are, as far as they are preserved, practically identical, in number, position, and amount of divergence from their common stalk, with those of *T. pallida*. The branches of the radius also agree in the two forms; and it should be noticed that the difference in level between the bifurcation of R_{4+5} and R_{2+3} is greater in these two wings than in the hindwing. We are justified, therefore, in concluding that *P. mitchelli* represents a forewing, and quite likely the forewing of the species of which *P. australica* is the hindwing; though, as this cannot be proved, I think we should retain the two names for the two separate specimens. As, however, the venation of different species of the genus *Permochorista* probably did not vary more than it does at the present day in species of *Teniochorista* and *Chorista*, I have shown the restoration given in Text-fig. 6 as that of a typical pair of wings for the genus *Permochorista*, the forewing being restored from *P. mitchelli*, the hindwing from *P. australica*. A comparison of this restoration with the wings of *T. pallida* will show us the small extent of the evolutionary process which has occurred in this very stable wing-type between Permian and recent times. It may be briefly summarised as follows:—

(1) Reduction in the number of branches of M, from six to four in the hindwing, and from six* to five in the forewing.

(2) A tendency for the cross-veins to arrange themselves more advantageously as supports for the main veins, alternately above and below any given main vein; and hence

(3) The breaking of the original regular course of the main veins into a very slight irregularity or zigzagging.

(4) Greater specialisation of the basal portion of Cu. In the Permian genus, Cu_1 has already fused with the main stem of M basally, and probably Cu_2 with 1A. In *Teniochorista* and other

* Although only five branches are to be seen in the part of the wing of *P. mitchelli* preserved to us, it will be quite evident that at least one extra branch is required more distally along M_2 in restoring this wing, unless we are going to allow a much greater divergence in the direction of these branches of M than is warranted by our knowledge of Mecopterous venation.

recent Mecoptera, the short basal pieces of Cu_1 and Cu_2 , from the cubital fork up to the point of fusion, tend to become perpendicular to the veins with which they junction, and so have at last assumed the appearance of mere cross-veins.

In concluding the account of this interesting fossil genus, I think that it may be reasonably claimed that *Permochorista* differed very little, either in its structure or its life-history, from the archaic genus *Tæniochorista* still existing in Australia at the present day.

The bearing of these Permian Mecoptera, and the still more archaic type, *Archipanorpa*, from the Ipswich Trias, on the problem of the origin of the Holometabolous insects as a whole, must be left to a later paper. It is only necessary to remark here, that the existence of a more archaic form (*Archipanorpa*) at a later horizon (Upper Triassic) need not cause us any surprise or misgivings. At the present day, we have in North America a species, *Merope tuber*, which is in many ways more archaic than even *Permochorista*; while, in the same region, there flourish the highly specialised types of the *Bittacideæ* and the wingless *Boreideæ*. The direct ancestors of *Archipanorpa* must have existed in the Permian, alongside *Permochorista*, and must have also been in existence long before this latter genus became evolved. In the finding of a few fossil types from two horizons in the Permian and Trias, from faunas that were probably highly complex in their composition, chance has happened to put into our hands one of the oldest types from the later horizon; whereas, from the earlier horizon, we have, in *Permochorista*, probably one of the most advanced insect-types of the age. One might, as a parallel, think of the possibility, at the present day, of finding a Butterfly-wing in the Miocene strata at Florissant, and a few days later picking up a much more archaic *Hepialid*-wing from the ground where it had just fallen. The amount of incongruity in both cases would be very much the same.

iii. Permian Insects *Incertæ Sedis*.

Specimen No.25.—An insect-wing with beautifully preserved outline, 10 mm. long by 3.3 mm. wide, with anterior and pos-

terior margins almost parallel. Anal veins very distinct; the rest obsolescent. Apparently R, M, and Cu arise from a common basal stalk, and diverge slightly distad. This wing might be the tegmen of a Permofulgorid closely resembling No.31 described above.

Specimen No.27.—The poorly-preserved distal portion, 6·5 mm. long, of a wing resembling No.25.

In both the above specimens, the posterior margin shows a very definite coriaceous border about 0·2 mm wide, along its entire length. I know of no Palæozoic type that shows this structure, which strongly suggests the suture of a Coleopterous elytron. The hypothesis that these wings might represent the first stages in the evolution of this latter type is a very tempting one, but should not, I think, be entertained on the basis of such poor material as we have in hand at present.

Specimen No 28.—A portion of a wing, 10 mm. long, showing indistinct subparallel veining. Not sufficiently characterised to classify.

Specimen No.29.—A small, broadly ovate fragment, 1·5 mm. long by nearly 1 mm. broad, carrying nine longitudinal veins, and distinctly convex. At first sight, this specimen is very much like the elytron of a Beetle. Careful examination shows, however, that the supposed margin is in reality only a broken edge, with no sign of a suture. Probably a small portion of a larger wing, and not sufficiently characterised to classify.

Specimen No.30.—Cannot be referred to the Insecta with any certainty.

Specimen No.32.—An impression of a small portion of a wing, 5·6 mm. long by 1·2 mm. wide, resembling, at first sight, the wing of a small Tipulid or a Mosquito. The venation is only visible in the short petiole, and along a very strong vein, probably the cubitus, which curves to the posterior border at about two-thirds the length of the wing. In strong oblique light, a row of large, widely-spaced cross-veins can be seen above this vein. Thus the impression is probably only a small fragment of a very large wing, and too incomplete to classify.

All the specimens here mentioned, except No.32, were found at Belmont.

SECTION B. THE TRIASSIC INSECTS.

Mr. Mitchell's Collection contains twenty-five specimens from the Wianamatta Shale Beds. Of these, No.10 is from Narellan, about five miles from Campbelltown, along the branch line from this latter town to Camden. The horizon of this specimen is probably about 700 feet above the top of the Hawkesbury Sandstone. The rest of the specimens, numbered 1-9, 11-22, and 34-36 inclusive, were taken in the railway-cutting at Glenlee, some four miles south of Campbelltown, on the main Southern Line. The horizon of these specimens is between 300 and 400 feet above the top of the Hawkesbury Sandstone.

The succession of strata from the Hawkesbury Sandstone to the Wianamatta Shales is not by any means continuous. For a long period subsequent to the elevation of the former, this series of rocks was subject to sub-aërial forces. Afterwards, the great subsidence of the area occurred, from the Blue Mountains to Bowral in the South. Into this depression, the Hawkesbury River emptied itself near Mulgoa, forming the Wianamatta Lake. When this lake was filled up, the excess of water was drained off through the original channel of the Hawkesbury River, until this became sufficiently degraded to cause the lake to disappear, and its area to be denuded, as we now observe it to be. Thus a length of time sufficiently long elapsed, between the end of the Hawkesbury Series and the beginning of the Wianamatta, to allow of the advent of many new forms of plants and animals, though *Teniopteris* and *Thinnfeldia* persisted through the two series.

As regards the age of the Wianamatta Series, I cannot do better than quote Mr. Walkom. In his last letter to me he writes, "On the evidence available, the Ipswich flora indicates distinctly an Upper Triassic age, possibly Rhætic, but more probably older (Keuper); also, the Wianamatta is probably of the same age." In the concluding portion of his work on the Flora of the Ipswich and Walloon Series,* which has just been pub-

* Mesozoic Floras of Queensland. Part i., concluded. The Flora of the Ipswich and Walloon Series. (*d*) Ginkgoales, (*e*) Cycadophyta, (*f*) Coniferales. By A. B. Walkom, B.Sc. Queensland Geological Survey, Publication No.259. Brisbane, 1917.

lished, Mr. Walkom sums up the evidence as follows:—"The Ipswich Series must be regarded as Triassic, perhaps homotaxial with the so-called Rhætic Beds of various areas, but possibly older."

DESCRIPTIONS OF THE SPECIMENS.

Order **PROTORTHOPTERA.**

Genus **NOTOBLATTITES** Tillyard.

Originally, I placed this genus in the Order Blattoidea. However, its wing-venation shows it to belong to Handlirsch's Order Protorthoptera, to which I now remove it. But it should be noted that the fossils of this genus preserved *in the resting-position* show us that it carried the tegmina folded flat along the back, as in the true Cockroaches; the hindwings being folded beneath them, and projecting a little beyond them. This shows, I think, that the Cockroaches do not really belong to a separate Order, but are a specialisation from a very ancient Protorthopterous type, the anal area of the tegmen becoming developed into a specialised convex clavus; whereas, in *Notoblattites* and other insects placed in the Protorthoptera, the wing-venation remained more primitive, with no specialisation of the anal area.

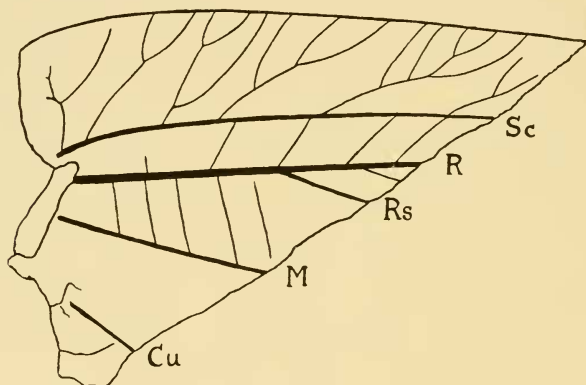
Notoblattites shows us that the typical resting-position of the Cockroaches was assumed *before* the specialisation of the tegmen set in. This resting-position is a specialisation from an original, flattened, roof-shaped position of holding the wings, which has become accentuated in most recent Orthoptera. It can be paralleled by the development of the same process in the Diptera, from a similar roof-shaped position of the wings in the ancestral Order Mecoptera.

The type of this genus is the large wing, *Notoblattites subcostalis* Tillyard, from the Wianamatta beds of St. Peter's, near Sydney. Two fragments of very fine wings, closely allied to this, are here described as new species.

NOTOBLATTITES WIANAMATTENSIS, n.sp. (Text-fig.8).

Greatest length of fragment, 28 mm., (measured from base of Sc to the distal broken end of C). The specimen shows the basal

half, or a little more, of the costal area, about half of Sc, a little less than half of R, but including the origins of the first two radial sectors, together with a short piece of the basal part of M and a fragment of Cu. The formation of this area is closely similar to that of the type-species, as regards the position of the main veins, but differs from it in the formation of the cross-veins. In the costal area of *N. subcostalis* (i.e., between C and Sc), the veins running from Sc to the border are mostly simple,



Text-fig.8.

Notoblattites wianamattensis, n.sp., (length of fragment 28 mm.).
Glenlee; Triassic.

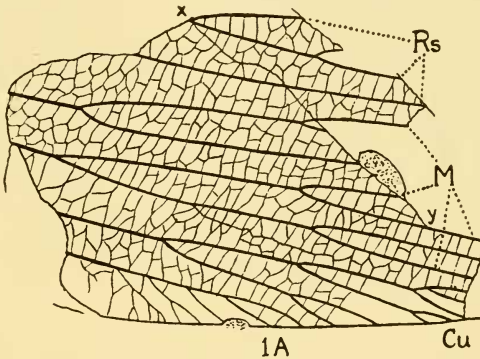
and never more than once branched. In the present species, they show considerable branching, one of the series preserved sending as many as five veinlets to the costal border. Again, in the area below Sc, the spaces between R and M, and again between M and Cu, are filled, in *N. subcostalis*, by a close mesh-work of tiny cellules; whereas, in the present species, these areas are only crossed by a few straight, oblique veins.

The fragment is beautifully preserved, on a dark greyish-black rock of fairly smooth surface, and bears the label "Glenlee, 18.9.92" in pencil in Mr. Mitchell's handwriting.

Type, Specimen No.3, in Coll. Mitchell.

NOTOBLATTITES MITCHELLI, n.sp. (Text-fig 9).

Greatest length of fragment, 24 mm. This specimen, which shows a remarkably close resemblance to the type-species, *N. subcostalis* Tillyard, is a beautifully preserved fragment, showing an area of the tegmen crossed by the distal half of the median vein, with a small portion of the radial sectors above it, and a considerable part of the cubital and first anal veins below it. The forkings of these veins are very regular and narrow, and the spaces between them are closely filled with a typical Palæodictyopterous meshwork, which is very well preserved. A comparison with the figure of the type-species of this genus, shows how closely similar this area of the tegmen is in the two species. Nevertheless, as the second branch of the radial sector above M



Text-fig.9.

Notoblattites mitchelli, n.sp., (length of fragment 24 mm.).

Glenlee; Triassic.

in the new species is definitely forked, whereas, at this same point in the type-species, there is only a simple longitudinal vein, I have decided to place this specimen as a new species, which I dedicate to its discoverer.

In the Collection, there were two specimens, Nos 1 and 2, which contained closely similar fragments of this insect. On fitting these together, I discovered that they were part and counterpart, respectively, of the same impression. As the two specimens do not cover quite the same area of the wing, I made

drawings of both. Then, having reversed one of these, I superimposed it upon the other, so that the greater part of the two fitted exactly. The complete figure in Text-fig.9 is the result of this process. The oblique line xy represents the broken edge of the rock on specimen No.1, the portion lying above and to the right of this line being present only in No.2, as well as a very small part of the extreme base of the fragment in the region of 1A.

Type, Specimens Nos.1 and 2 (part and counterpart) in Coll. Mitchell. No.1 bears, on its back, a circular label, with the words "Neuropterid, Glenlee Rwy. cttg., Narellan."

I have not indicated here to what family these interesting insects belong. It is probable that a new family will have to be formed for their reception later on. I will only mention here two interesting points about them; firstly, that, if the Palæodictyopterous meshwork were to become obsolescent, the dichotomous branchings of the veins in the distal part of the tegmen would show considerable similarity to the remarkable venational type of the Protomecoptera, as exemplified by *Archipanorpa magnifica* Tillyard, from Ipswich; and, secondly, that these large insects show no sign of the typical curvature of the anal veins found in the Blattoidea, and are more correctly placed, therefore, in the Order Protorthoptera of Handlirsch.

Order **MECOPTERA.**

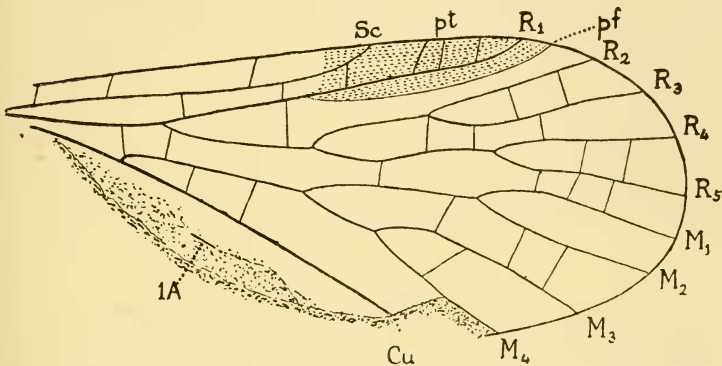
Family MESOPANORPIDÆ, fam.nov.

Scorpion-flies with broadly rounded wings, narrow at the base. Pterostigma large, well-developed, bordered posteriorly between R_1 and R_2 by a strongly marked pterostigmatic furrow. Both R_s and M normally four-branched, but the dichotomy of R_{2+3} taking place at a level nearer to base than does that of R_{4+5} . This character appears to be unique amongst Mecoptera, both fossil and recent. Cu_1 a strong, straight vein, from which M arises not far distad from base. Cross-veins mostly indistinct, but a number of stronger ones placed in advantageous positions, resulting in a certain amount of bending of the main veins at the points of junction.

Genus *MESOPANORPA*, n.g. (Text-fig.10).

Characters as for the family, with the following additions. Rather small insects, wings about 8 mm. long. Sc well-developed, running into the pterostigma; its distal end somewhat indistinct. R_{4+5} and M_{1+2} connected just before midway by a strong cross-vein, towards which both are somewhat bent at their points of junction with it. The levels of the forkings of these two veins are the same, and lie much further distad than the levels of the forkings of both R_{2+3} and M_{3+4} . The fourth apical fork, between M_3 and M_4 , is exceptionally broad.

Genotype, *Mesopanorpa wianamattensis*, n.sp.



Text-fig.10.

Mesopanorpa wianamattensis, n.g. et sp., (length of fragment 7.5 mm.).
Glenlee; Triassic; *pf*, pterostigmatic furrow; *pt*, pterostigma.

MESOPANORPA WIANAMATTENSIS, n.sp. (Text-fig.10).

An almost complete wing, well preserved, but with the extreme base and the anal area missing as far as the whole of 1A. Total length of fragment, 7.5 mm., (complete wing probably 8 or 8.5 mm.). Greatest breadth, 3 mm., in region of pterostigma. Probably three strong cross-veins in costal space; three weak ones in pterostigma, and a number of weak ones placed irregularly on the wing, as indicated in Text-fig.10. Rs arising from R at a level slightly distad from that of the origin of M from Cu.

Type, Specimen No.5 in Coll. Mitchell. The impression is

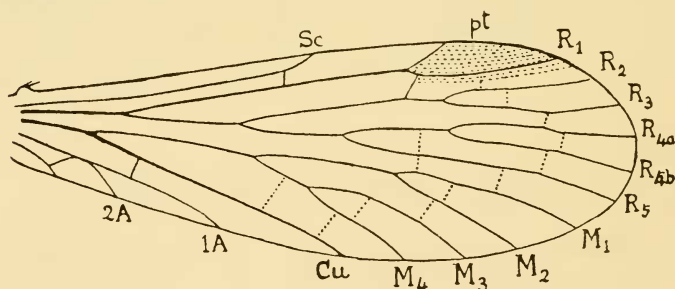
on a hard, dark brown rock with rather uneven surface; the main veins are beautifully preserved, and were evidently strongly chitinised.

It is not easy to determine whether this wing should be placed in the Order Mecoptera or in the Trichoptera, which, in Mesozoic times, were only just separated off from the older Mecoptera, and closely resembled them in the venation of the *forewing*. But the following considerations have all weighed with me in placing it in the older Order Mecoptera.

(1). The presence of numerous cross-veins, many irregularly placed in positions of no special advantage. (Probably there were other cross-veins as well as those I have shown, but not sufficiently well preserved to be visible).

(2). The absence of the typical Trichopterous wing-spot between R_4 and R_5 , not far from the origin of these two veins. If this spot had been present, I think the wing is well enough preserved for it to have shown up quite clearly.

(3). The close resemblance in shape to the wing of *Panorpodes*, in the narrow base and well-rounded tip of the wing.



Text-fig. 11.

Panorpodes carolinensis Banks, hindwing. Recent; N. America. For comparison with *Mesopanorpa*. The dotted cross-veins are almost obsolete; *pt*, pterostigma.

(4). The close resemblance between the venation of the fossil and that of the *hindwing* of *Panorpodes* (Text-fig. 11). The only important difference is that, in *Panorpodes*, R_{4+5} sends three veins to the apical border. Now, *if the most posterior of these*

three veins became suppressed, the result would be to place the remaining dichotomies of Rs in this recent genus at about the same levels as they are in *Mesopanorpa*

Of course, if it is agreed that the specimen represents a hind-wing (and I think that the condition of the forking of M from Cu strongly indicates this), then the Trichoptera are put clean out of court, since their hindwings are developed on quite different lines, besides being mostly much too weakly chitinised to be preserved in the fossil state.

The genus *Mesopanorpa* is evidently not at all closely related to the Permian *Permochoristidæ* dealt with in the first section of this paper, nor to the recent Australian *Choristidæ*. The genus *Mesochorista* from the Ipswich Trias is, however, a Mesozoic link between these two families. Hence *Mesopanorpa*, like the Triassic *Archipanorpa* and the recent *Nannochoristidæ*, is a representative of quite another line of Mecopterous development. We may confidently expect that, when the Australian Permian and Mesozoic insect-faunas are better known, many new types of development of this ancient and once dominant Order will be brought to light.

Order COLEOPTERA.

The placing of single elytra, however perfect, can seldom be more than a matter of conjecture, since there are scarcely any types of sculpture that are confined to one family only. But, where the fossil specimen is well enough preserved, it is nevertheless usual to name it. Thus, a number of what may be termed "genera of convenience" have arisen, of which it may be said that each one serves to gather together, as a single group, all those fossil elytra which show correspondence in shape and sculpture, within certain limits. An example of such a genus is *Ademosyne* Handlirsch, from the Ipswich beds. Under this name are now comprised no less than ten species, which might belong to the *Hydrophilidæ*, *Parnidæ*, or *Tenebrionidæ*, the type of elytron which they represent being commonly found in all three families.

Most of the elytra in the present collection are not well enough preserved to merit names; but there are five which I

consider of sufficient interest to name, placing them only provisionally in families to which they may possibly belong.

Family HYDROPHILIDÆ(?).

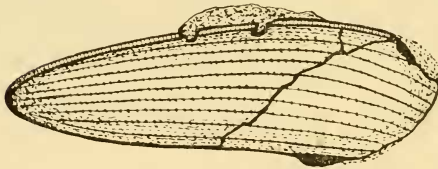
Genus ADEMOSYNE Handlirsch.

ADEMOSYNE WIANAMATIENSIS, n.sp. (Text-fig.12).

Total length of elytron 4.5 mm.; greatest breadth 1.5 mm. Shape elongate-oval, closely similar to that of *A punctata* Tillyard, from the Ipswich beds. *Sculpture*: nine longitudinal striæ carrying very fine, closely-set punctures, and separated by smooth interstices of slightly greater width than the striæ. The suture is well-marked, and is not straight, but slightly waved, as in the type-species, *A. major* Handlirsch, from Ipswich.

Type, Specimen No.10 in Coll. Mitchell.

Locality: Narellan, near Campbelltown, N.S.W. Not



Text-fig.12.

Ademosyne wianamattensis, n.sp., elytron
(length 4.5 mm.). Narellan; Triassic.

taken from the same locality as the other Wianamatta fossils here described, but from an horizon some three or four hundred feet higher, *i.e.*, about 700 feet above the top of the Hawkesbury Sandstone. The specimen is preserved in a soft, yellowish mudstone, and is remarkable for its state of preservation. A portion of the base of the elytron has peeled away, leaving only a faint impression on the rock; but all the rest, including the whole of the apical half, and nearly all the margin up to the base, shows *the original elytron in position*, darkly coloured, and exhibiting a peculiar kind of iridescence. It would thus appear that this elytron has been preserved almost without change of the chitin of which it is composed, as is often the case in *Tertiary* fossils, but, as far as I know, never before recorded for Mesozoic fossils of this kind. I think the explanation lies in the type of rock in which it is embedded, which may be particularly suitable for the preservation of chitinous objects.

This fossil is closely allied to *A. punctata* Tillyard, from the Ipswich beds, from which it differs in its slightly greater length

and width (*A. punctata* is 4 mm. long, by 1 mm. wide) and in lacking the interstitial punctures peculiar to that species.

It is possible that this fossil may prove to be of some considerable geological interest, especially if a further search in the same locality were to reveal specimens of the genus *Ademosyne* in great numbers. For these beetles are very common in the Ipswich beds; and, indeed, form a unique fauna there, since they have hitherto not been found in the Wianamatta Shale or in any other Mesozoic beds. If, therefore, it could be shown, by further investigations, that there exists a definite *Ademosyne*-zone at Ipswich, and that the same zone occurs at Narellan at the horizon of this specimen, it would be logical to regard the result as a proof of the correlation of the Ipswich Fossil Bed with this upper zone of the Wianamatta Shale Beds. Such a conclusion would agree very well with the indicated view that the Wianamatta Beds at St. Peter's and Glenlee (*i.e.*, from six to three hundred feet lower in horizon than the supposed *Ademosyne*-zone), show a fauna and flora somewhat older than those found at Ipswich.

Family ELATERIDÆ(?).

Genus ELATERIDIUM, nom.nov.

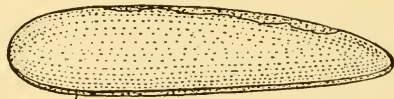
Elaterites Tillyard, Mesozoic and Tertiary Insects of Queensland and New South Wales, 1916, p.41.

Genotype, *E. wianamattense* Tillyard, from St. Peter's, near Sydney.

I propose this name for my genus, the name *Elaterites* being preoccupied by a genus of Upper Miocene elytra from Oeningen, Switzerland. The type of this latter genus is *E. lavateri* Heer.

ELATERIDIUM ANGUSTIUS, n.sp. (Text-fig.13).

An almost complete specimen of a long, narrow elytron, closely resembling the type-species, *E. wianamattense*, but differing from it in its greater narrowness in comparison with its length. Total length, 9 mm.; greatest breadth, 2 mm., not far



Text-fig.13.

Elateridium angustius, n.sp., elytron (length 4 mm.). Glenlee; Triassic.

from base. The suture is well-marked; the whole elytron, including the suture, is very finely but distinctly granulate all over. Convexity slight.

Type, Specimen No.14 in Coll. Mitchell

Family TENEBRIONIDÆ.

Genus ADELIDIUM, n.g.

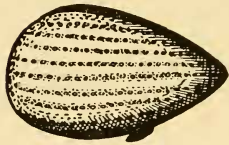
Broad, highly convex elytra of small size, evidently belonging to a beetle with a broad, heart-shaped body. Suture narrow. Sculpture consists of about nine slightly raised, longitudinal striæ, separated by wider interstices; the former regularly punctate, each puncture being a tiny, shallow, circular depression.

Genotype, *Adelidium cordatum*, n.sp.

The name is given to suggest the close resemblance between this elytron and those of the recent genus *Adelium*, well represented in Australia at the present day.

ADELIDIUM CORDATUM n.sp. (Text-fig.14).

A beautifully preserved elytron, 4 mm. long, by 2.2 mm. wide at its greatest width, near the base. *Shape* well rounded towards the base, strongly pointed at apex. *Sculpture*: the longitudinal striæ very regularly punctate, the distance between the punctures being slightly less than the width of the inter-



Text-fig.14.*

stices.

Type, Specimen No.17 in Coll. Mitchell.

It is possible that this species is closely related to some of the species of *Ademosyne* described from Ipswich, but none of these approach it in breadth or convexity.

Family MALACODERMIDÆ.

Genus METRORHYNCHITES Tillyard.

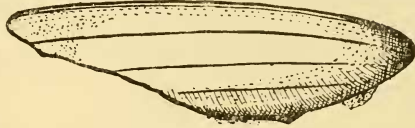
Tillyard, *loc. cit.*, p.41.

Genotype, *M. sydneyensis* Tillyard, *l.c.*, p.41.

* *Adelidium cordatum*, n.g. et sp., elytron (length 4 mm.). Glenlee; Triassic.

METRORHYNCHITES GRANDIS, n.sp. (Text-fig.15).

This specimen consists of a considerable portion of a large, elongated, and highly convex elytron, with sharply pointed apex. The suture is well preserved, from apex nearly to base; but a fracture of the rock, running obliquely across the elytron, has cut off all but a small portion of the margin. *Total length*



Text-fig.15.

Metrorhynchites grandis, n.sp., elytron (length of fragment 14·4 mm.). Glenlee; Triassic.

of fragment, 14·4 mm.; *greatest breadth preserved*, 3·7 mm., but the elytron was evidently considerably wider towards the base. *Sculpture*: finely granulate all over, including suture; three weakly impressed, longitudinal striæ at wide intervals apart, and tending to vanish towards the apex.

Type, Specimen No.20 in Coll. Mitchell.

Only doubtfully referable to *Metrorhynchites*, from which it differs in its greater size, its more sharply pointed apex, and in the fact that the three longitudinal striæ are not nearly so well marked as in the type-species, and do not unite together towards the apex.

The specimen is a cast of a left elytron, very well preserved, except for the fracture.

Order **HEMIPTERA**. Suborder **Homoptera**.

Family **PSYLLIDÆ**.

Genus **TRIASSOPSYLLA**, n.g. (Text-fig.16).

Moderate-sized insects, forewing probably about 6 mm. Forewing broad, with well-rounded apex. Five separate veins ending up on the apical portion of the wing-margin; of these, the two anterior probably represent branches of R_1 , the third appears to be the unbranched R_s , the fourth and fifth M_1 and M_2 respectively. Sc present, almost, if not quite, fused with R . Wing-membrane quite smooth.

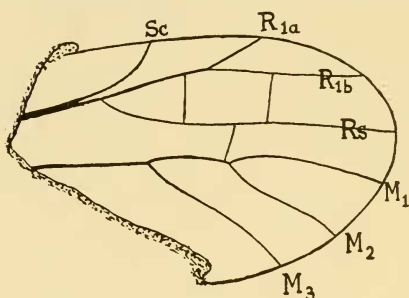
Genotype, *Triassopsylla plecioïdes*, n.sp.

In spite of some obvious resemblance to the wings of the family *Bibionidæ* in the Diptera Nematocera, and in particular

to the recent genus *Plecia*, I think that this wing is more properly placed with the *Psyllidæ*; or perhaps it might be put into a new family, which would represent the ancestral form from which both *Psyllidæ* and *Aphidæ* later sprung. The resemblance, both to certain types amongst the *Psyllidæ* of the present day, and also to the genus *Schizoneura* amongst the *Aphidæ*, is marked enough to make this possible.

TRIASSOPSYLLA PLECIOIDES, n.sp. (Text-fig.16).

A portion of a wing 4.6 mm. long, by 2.8 mm. wide, with most



Text-fig.16.

Triassopsylla plecioides, n.g. et sp., wing
(length of fragment 4.6 mm.). Glenlee;
Triassic.

of the basal half missing, but the whole of the apical half preserved. The main veins are very well shown, and appear to consist of the upcurved end of Sc, the forked end of R₁, a simple Rs reaching the border at the extreme apex, and a three-branched M whose stem is converging basad towards R. Type, Specimen No.4 in Coll. Mitchell.

The specific name, *plecioides*, has been given to this type, to indicate the resemblance in its venation to that of the genus *Plecia* of the family *Bibionidæ*. Unless the basal portion of the wing is preserved, it is quite impossible to separate certain reduced types of venation in the Diptera from similar types in the Homoptera. No undoubted Diptera have yet been found earlier than the Lias, whereas the Hemiptera go back to the Permian. These facts alone must make one hesitate as to any possible Dipterous affinities for this wing.

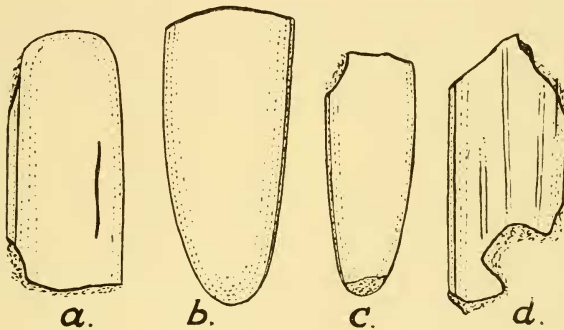
TRIASSIC INSECTS INCERTÆ SEDIS.

1. *Coleoptera incertæ sedis*. (Text-fig.17).

Specimen No.9.—A well-preserved fragment of a large elytron, measuring 11 mm. by 4.7 mm., and showing part of the suture,

but without any sculpture whatever. What appears to have been a crack or break in the original elytron, before it became fossilised, is strongly marked on it far from the margin, as shown in Text-fig.17*a*.

Specimen No.12.—A well-preserved and nearly complete elytron of considerable size, with only the base missing; 12·5mm. long by 4·8 mm. wide. Suture very narrow; apex moderately pointed. Sculpture: very finely granulated all over. (Text fig. 17*b*).



Text-fig.17.

Elytra of Coleoptera Incertae Sedis, from the Wianamatta Shale Beds at Glenlee; Triassic.

Specimen No.16.—A small convex elytron, 2·7 mm. long, by 1 mm. wide, without any definite markings.

Specimen No.34.—A nearly complete, very convex, elongated elytron, 10 mm. long, by 3·3 mm. wide, sculptured all over with shallow pits arranged in longitudinal lines. (Text-fig 17*c*).

Specimen No.36.—A portion of the mould of a large elytron, 8·8 mm. long, measured along the preserved portion of the suture, and 5·5 mm. wide. Sculpture: finely punctate all over, with traces of three double longitudinal ribs, as in Text-fig.17*d*.

2. Hemiptera incertae sedis.

Specimens numbered 7, 8, 11, 13, are fragments of strongly tuberculate Hemipterous tegmina, but there is not sufficient of the venation preserved to allow of classification into any definite families.

Specimens numbered 6, 15, 18, 19, 21, 22, and 35 are not characterised, as far as I can see, by anything that would enable them to be definitely determined as insect-remains. Nos. 6, 18, 19, and 35 are densely veined fragments, which appear to me to be plant- rather than insect-remains.

Note on a Silurian Fossil.—The specimen numbered 33, found in Silurian rock, appears, at first sight, to be a passable beetle-elytron. On closer examination, no trace of a true suture or margin can be seen, and the longitudinal striæ show a characteristic, oblique cross-striation which does not occur in any insect known to me. This fossil would appear to be a small portion of a closely ribbed Brachiopod shell, very probably belonging to the genus *Pentamerus*.

Note.—Only a week or two after the completion of this paper, I received from Mr. Herbert Bolton, M.Sc., Director of the Bristol Museum, England, a copy of his paper on the "Mark Stirrup" Collection of Fossil Insects from the Coal-Measures of Commentry (Allier) France (Mem. Proc. Manchester Lit. Phil. Soc., 1917, Vol.61, Pt.1). Amongst these Upper Carboniferous Insects described in this excellent paper, there is one, *Sycopteron symmetrica*, n.g. et sp., which the author considers to be most probably a Panorpid. After reading the description and studying the figures, it is clear to me that this insect is more likely to be an archaic type of Psocid; but it is not well enough preserved for its affinities to be determined with certainty.—R.J.T.